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ABSTRACT

This paper presents a study of the relationship between scores on the Bayley measures of mental and motor development administered at 8 months of age and performance on measures of cognitive development and school achievement administered at ages 4, 5, 6, and 7. Also studied are changes in this relationship which occur when children with extreme scores on the infant measures are considered separately and changes which result when scores of children from differing socioeconomic status groups are compared. A review of literature related to infant test performance and later measures of intelligence and achievement is presented. Subjects for the present study were 1382 children who were participants in two previous longitudinal studies. In addition to Bayley infant scores and the subsequent cognitive and achievement measures, a measure of socioeconomic status was obtained for each child. Although moderate correlations were found between infant and outcome measures for the group as a whole, results more consistently indicated that low performance on the Infant Scales was associated with lowered performance on all of the intellectual and achievement measures, whereas high performance on the infant measures bore no relationship to performance on eight of the nine outcome measures. Results further indicated that SES was more clearly related to later performance for subjects with high infant scores than for subjects with low or middle range scores. (BD)

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RELATIONSHIPS BETWEEN BAYLEY INFANT SCALES AND MEASURES OF COGNITIVE DEVELOPMENT AND SCHOOL ACHIEVEMENT

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RELATIONSHIPS BETWEEN BAYLEY INFANT SCALES AND MEASURES OF COGNITIVE DEVELOPMENT AND SCHOOL ACHIEVEMENT

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The purpose of the present investigation is to determine the relationship between scores on the Bayley measures of Mental and Motor development administered during infancy and performance on measures of cognitive development and school achievement administered at ages four through seven.

In 1955 Bayley stated that "it is now well established that we cannot predict later intelligence from the scores on tests made in infancy (p. 806)." This conclusion was based on results obtained from the Intensive Growth Study (Bayley, 1933; 1949; 1958) in which a group of subjects who had been administered the Bayley Scale during infancy were tested repeatedly over a period of 18 years. The sample was above average in socioeconomic status as reflected in parents' occupation and level of education. The Bayley Scale was administered up to age 2, the California Preschool Schedules were administered up through age 5, the Stanford-Binet from ages 6 to 14, and the Wechsler-Bellevue Scale at age 18. Findings generally indicated that as the time span between two testing periods increased, the correlations between test scores decreased. Lack of significant correlations between

[1] The authors wish to thank Jeanne Dorle for her contribution in computer analyses of study data. Thanks are also due to Carol Hara and Marilyn Johnson for their assistance in preparation of the manuscript.

scores on the 8 month Bayley and the California Preschool, the Stanford-Binet, or the Wechsler-Bellevue supported the conclusion that infant tests did not predict performance on later tests of intelligence.

An investigation similar in design to the Bayley study of over 200 subjects who were followed over the age range from 21 months to 18 years (Honzik, Macfarlane & Allen, 1948; Macfarlane, 1953) found that the correlation between 2 year and 18 year tests ($r = .31$) was far lower than the correlation between 6 year and 18 year tests ($r = .61$), and that changes in absolute level of IQ were more marked below age six. They concluded that test scores at the lower age levels were of little predictive significance.

Other infant tests have also been used to predict later intelligence. In the Fels Study of Child Development (Nelson & Richards, 1938), a correlation of .46 was found between the Gesell Developmental Scale administered at 6 months and Stanford-Binet mental age at 36 months based on a sample of 31 subjects. Anderson (1939) conducted a longitudinal study of 91 subjects tested with a specially developed infant scale composed of items drawn from Gesell, Bühler, Linfert and Hierholzer, and additional items developed by Anderson. Subjects in this study were drawn from superior socioeconomic homes and had a mean IQ of 116.1 at age five. The correlation between scores on this test at 6 months and Stanford-Binet IQ scores at age 5 was -.065. No significant relationship was found between infant test scores and 5 year Binet scores until the subjects reached 18 months of age. Anderson concluded that this type of infant test had little predictive value in regard to later intelligence.

The predictive efficiency of the Cattell Infant Intelligence Scale (CIIS) was evaluated in the Child Growth Study by Cavanaugh, Cohen, Dunphy, Ringwall and Goldberg (1957). Subjects were administered physical, neurological, electroencephalogram and intellectual examinations at six month intervals beginning at birth. The correlation of .20 between the 6 month CIIS and the 48 month Binet IQ scores for 61 subjects was not significant. There were no significant differences between mean IQ scores on the CIIS at 12, 18 and 24 months, or between the Stanford-Binet mean scores at 36, 48, and 60 months of age, but the overall Stanford-Binet mean was significantly higher ($p < .01$) than the overall mean scores of CIIS. It was concluded that the two tests tap different intellectual functions. Subjects were above average in intellectual ability, as indicated by the mean IQ of 119.6 obtained at 36 months.

The lack of association between infant tests and later measures of intelligence reported in the above studies has been called into question because study samples tended to be drawn from above average socioeconomic groups and frequently excluded mentally subnormal infants (i.e., Bayley, 1933; Anderson, 1939; Cavanaugh et al., 1957). It has been pointed out (Illingworth, 1961) that one cannot generalize to the whole range of intelligence findings which are based only on selected portions of that range.

Knobloch and Pasamanick (1960) investigated the relationship between infant tests and later measures of intelligence with subjects representing the full range of intellectual capacities. The Gesell Developmental Scale was used to evaluate 492 full-term subjects at approximately

40 weeks of age. At three years of age available subjects were re-tested with both the Gesell and the Stanford-Binet. The correlations between the 40 week Gesell and the 3 year Gesell and 3 year Stanford-Binet were .51 and .48 respectively. When subjects were divided into normal (n = 147) and abnormal (n = 48) groups the correlation between the 40 week Gesell and 3 year Gesell for the normal cases was .43 while the correlation between these tests for the abnormal cases was .74. It was also found that 75% of the subjects changed less than 15 DQ points between the ages of 40 weeks and 3 years. Knobloch and Pasamanick concluded that infant tests did have value in predicting later intellectual status, especially among infants with neurological or intellectual abnormalities.

Illingworth (1961) also found that infant tests have predictive validity, especially for infants of low ability. Of 122 subjects diagnosed as mentally inferior during their first year, on the basis of a modified Gesell, 87 were re-assessed at school age. Considering an IQ of less than 70 as subnormal, Illingworth found that 75% of the subjects had been correctly classified during the first year. Of the 39 subjects diagnosed as subnormal during the first 6 months and available at the time of follow-up, 69% had been correctly classified. Illingworth concluded that the correlation between test scores in infancy and intelligence in later years will never be high, except in the case of subnormal infants.

A study by Escalona and Moriarty (1961) found limited support for predictive validity of infant tests. Subjects were selected on the basis of "normalcy" with respect to medical, social, and developmental criteria; thus, the relationship between infant tests and later measures

of intelligence may have been truncated because of the lack of inclusion of mentally subnormal subjects. Both the Cattell and the Gesell were administered to 58 subjects between the ages of 3 weeks and 33 weeks; all IQ's were above 90. The WISC was administered when the subjects were 7 to 8 1/2 years of age. In general, the authors found no significant relationships between the Cattell and the WISC, or the Gesell and the WISC.

Drillien's (1961) study of prematurely and maturely born infants lends support to the hypothesis that infant tests have predictive value. Subjects (N = 600) were examined at 6 month intervals through the age of 2, and at yearly intervals thereafter using items from the Gesell and the Terman-Merrill. A correlation of .54 was obtained between 6 month Gesell and 5 year Terman Merrill scores of 237 subjects. The Terman-Merrill testing resulted in 16 subjects being classified as Ineducable (IQ < 70), 16 subjects as Borderline (IQ of 70-79), and 14 subjects as Dull (IQ of 80-89). Seventy-five percent of the Ineducable and Borderline subjects and 71% of the Dull subjects had been correctly classified at 6 months. Drillien concluded that infant tests have most predictive validity in the case of subnormal mental functioning.

In this same study, Drillien also compared the developmental quotient (DQ) of subjects by age and by grade of maternal care, classified as best (middle class and superior working class), average (average working class), and worst (poor working class). When the subjects were 3 years of age, there was an 11 point DQ difference between the best grade of maternal care and the worst grade (108 vs. 97); while, at the age of 5

the difference in IQ between these two classes had increased to 23 points (118 vs 95). In both instances the middle grade of maternal care maintained an intermediate position between the best and the worst grades.

Knobloch and Pasamanick (1963) reviewed findings of other researchers and also summarized outcomes of their own five year follow-up study in regard to the predictive validity of tests in infancy. They concurred with previous findings that after 16 weeks of age infant tests have potential for discriminating mentally subnormal infants from those who are normal or superior. It was emphasized that when subnormality is determined at an early age it is almost always associated "with a pathological condition of some sort that precludes normal intellectual development (p. 45)." They further suggested that children with familial retardation who later function at the upper end of the subnormal group will not be identified on infancy evaluations because they will be entirely normal in their first year.

Knobloch and Pasamanick compared DQ's of full-term infants grouped by age, race, and education of the mother as the criterion for socio-economic status. At 40 weeks there were essentially no differences between black and white subjects, or between subjects grouped according to mother's education; while at 3 years of age there was not only a difference among the educational levels, but also between the races. At the 3 year level, white subjects whose mothers' education was less than

9 years had a mean DQ of 109, while black subjects had a mean DQ of 90; among those subjects whose mothers had educations of 12 years or more, white subjects had a mean DQ of 115, while black subjects attained a mean DQ of 105. The authors maintained that if a child is normal as an infant, one can predict the direction of change in IQ that will take place on the basis of the socioeconomic status of the parents. This assertion is supported by data presented by Drillien (1961) as well as by their own findings.

In a later study by Knobloch and Pasamanick (1967) the complete Gesell Developmental and Neurological Examination was administered to a group of subjects which included both normal infants and those manifesting major motor and mental deficits. The correlation between scores on the Gesell and scores on the Stanford-Binet obtained between the ages of 6 and 9 years for the total group of 123 subjects was .70; for a subgroup of 28 subjects whose DQ was less than 80, the correlation was .68. For those with DQ's of 80 or above (n = 88) the correlation fell to .48. These results lend further support to the hypothesis that infant tests have value in the prediction of later intellectual development, particularly for those at the lower end of the continuum.

Werner, Honzik and Smith (1968) did a follow-up of infants born on Kauai in 1955, who were still living in Hawaii ten years later. They found that the Cattell Scale at 20 months was the single best predictor of 10 year IQ as measured by the Primary Mental Abilities Test (PMA), with a correlation of .40. If a subject scored below the mean of the PMA, the WISC was administered. For children with IQs less than 80 the correlation between the Cattell and the WISC was .71.

Two studies using the data pool of the Collaborative Project for the Study of Cerebral Palsy, Mental Retardation, and Other Neurological and Sensory Disorders of Childhood have related infant test scores to later intellectual development. Gannon (1966) used the New Orleans sample composed of 384 black subjects, whose families were well below average in socioeconomic status. The Bayley Infant Mental and Motor Scales were administered at approximately 8 months of age while the Stanford-Binet was administered at approximately 48 months of age. The sample was divided into two equal subgroups in order to test the reliability of the findings. The correlation between the Mental Scale and the Stanford-Binet for Sample A was .28 ($p < .01$), for Sample B the correlation was .25 ($p < .05$). The correlations between the Motor Scale and the Stanford-Binet of .12 for Sample A and of .11 for Sample B were not significantly different from zero. Gannon concluded that the Bayley Mental Scale was significantly associated with later intelligence as measured by the Stanford-Binet at 4 years of age.

Ireton, Thwing and Gravem (1970) conducted a similar study using Collaborative Project data collected at the University of Minnesota on a sample composed of 536 full-term subjects who appear to be fairly representative of an urban, white population. The mean 8 month Bayley score was 79.1, while the mean 4 year Stanford-Binet IQ was 106.1. When analyzed by sex, it was found that the 8 month mental test was significantly ($p < .001$) related to the Stanford-Binet for both males and females with correlation coefficients of .28 and .23 respectively. While socio-economic status (SES) was not significantly related to the 8 month

Bayley scores for either sex, the correlation between SES and 4 year IQ was .43 for males and .38 for females, both correlations significant at the .001 level. Of those subjects who scored more than one standard deviation below the mean of the group on the 8 month mental scale, 40% scored below 85 on the 4 year intelligence test. Also, a significantly greater percentage (22.5%) of subjects who came from low SES families had IQ scores below 85. The authors suggested a predictive relationship between infant tests and later IQ performance, with the most significant relationship between low mental score and below-average later intelligence. The data from this study indicated that a low mental score at 8 months was a better indicator of below-average intellectual performance at age 4 than was low SES.

In summary, available evidence indicates that infant tests are most highly related to later intellectual performance among mentally subnormal children while these measures are relatively ineffective in predicting later intellectual superiority. It has further been suggested that environmental factors may influence intellectual development in such a manner that one can predict the direction of IQ change on the basis of parents' socio-economic status.

The present investigation is designed to determine: (a) the overall magnitude and duration of relationships between the Bayley infant scales and later intelligence and school achievement; (b) whether or not relationships between infant performance and later outcomes for those who obtained extreme scores on the initial measures differ from relationships which are obtained for the total study sample; and (c) the extent to which SES interacts with the infant measures in prediction of later outcomes.

Procedure

Sample

The 1382 subjects in the present study were all participants in both the Educational Follow-Up Project, a longitudinal investigation of the educational and behavioral outcomes associated with prenatal, perinatal, and early childhood conditions and events (Balow, et al, 1969) and the Minnesota section of the national Collaborative Project (Berendes, 1966).[2] Descriptive statistics for the present study sample on variables included in this investigation are reported in Table 1. Subjects were normally distributed about a mean of 104.0 on the Stanford-Binet and a mean of 103.2 on the WISC with standard deviations of 15.9 and 14.0, respectively. The mean score of 5.3 on the Socioeconomic Index falls within the middle range for the U. S. population on this same measure.

Table 1 about here

Measures[3]

Bayley Mental Scale (Perinatal Research Branch, research form)--administered at eight months includes items involving attention, imitation and

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[2] This study, "The Collaborative Project for the Study of Cerebral Palsy, Mental Retardation, and Other Neurological and Sensory Disorders of Childhood," was a major investigation in 12 medical centers of the antecedents of neurologically related childhood disorders.

[3] Eight month, four year, and seven year developmental and psychological examinations were administered at the University of Minnesota Hospitals and made available through the cooperation of the Collaborative Project under the direction of Dr. Robert O. Pasch. Information regarding five and six year school readiness and language development was obtained as part of the continuing data collection activities of the Educational Follow-Up Project.

comprehension, simple vocalization, and memory.

Bayley Motor Scale (Perinatal Research Branch, research form)—administered at eight months includes items involving gross and fine motor coordination, mobility, and prewalking progression.

Socioeconomic Index (SEI)—scores were derived from a formula used by the U. S. Bureau of the Census based upon parental occupation, education, and family income which yields composite scores on a ten point scale ranging from 0 to 9.9. The mean for the population of the United States falls in the range between 5.0 and 5.9 (Myrianthopoulos & French, 1968).

Stanford-Binet (L-M, Short Form)—administered at age four.

Metropolitan Readiness Tests (MRT)—designed to measure skills and abilities which contribute to readiness for initial first grade work such as auditory and visual perception, motor coordination, linguistic skills, knowledge of numbers, and ability to attend to and follow directions, was administered at age five and again at age six.

Illinois Test of Psycholinguistic Abilities (ITPA) (1961, Experimental Edition)—designed to measure specific aspects of psycholinguistic ability in the areas of encoding, decoding, associating, and sequencing, was administered at age five and again at age six.

Wechsler Intelligence Scale for Children (WISC)—administered at age seven.

Wide Range Achievement Test (WRAT)—which measures word pronunciation, spelling, and arithmetic computation, was administered at age seven.

Analysis

Pearson product-moment correlations were used to determine the relationships between Bayley scores and outcome variables for the total study sample. Subjects were then grouped according to performance on each of the Bayley measures. Subjects who scored in the upper and lower 5% were designated as the High and Low groups respectively, while the remaining 90% were designated as the Middle group. Analysis of variance procedures[4] were used to compare mean scores of the High, Middle and Low Bayley Mental and Bayley Motor groups on each of the study variables.

In those instances where the analysis of variance revealed significant differences among mean scores, the Newman-Keuls test (Winer, 1962) was used to determine the significance of the differences between pairs of mean scores included in the ANOVA.

For further analysis the High and Low Bayley groups were each subdivided according to socioeconomic level. Those whose SEI scores fell within the upper and lower 25% of the study sample were classified as High and Low SES respectively, while those scoring within the middle 50% of the study sample were classified as Middle SES. Analysis of variance procedures were then used to compare mean scores of the three SES subgroups within each of the High and Low Bayley groups.

Results

Table 2 about here

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[4] Conducted at the University of Minnesota Computer Center using the Statistical Package for the Social Sciences (SPSS) One Way Analysis of Variance program.

Product-moment correlations between scores on the Bayley Scales and measures of socioeconomic status, intelligence, school readiness, language development, and academic achievement are presented in Table 2. All correlations were significant at the .01 level. Both Bayley scales correlated most highly with the Stanford-Binet, the ITPA, and the six-year MRT (r's = .21 to .26), while the lowest correlations were found between the Bayley Scales and Socioeconomic Index scores (r's = .05 and .08). The intercorrelation between the two Bayley Scales was .55.

Table 3 about here

As shown in Table 3 the differences among High, Middle and Low subjects grouped according to scores on the Bayley Mental Scale as well as among High, Middle and Low subjects grouped according to Bayley Motor scores were all significant beyond the .001 level. However, further analysis of differences between Low and Middle and between Middle and High groups using the Newman-Keuls test of significance of differences between pairs of mean scores revealed that, with only one exception, the differences among the three groups were actually the result of the low scores obtained by subjects in the Low Bayley groups. There were no significant differences between scores of the Middle and High groups as classified on either the Mental or the Motor Scale on any study variable other than the four-year Binet. On the Binet there was a significant difference between High and Middle as well as between the Middle and Low Bayley Mental groups.

Tables 4 & 5 about here

As shown in Table 4, members of the Low Bayley Mental group almost never scored within the top 5% on the outcome variables. However, approximately 25% of the Low group scored within the lowest 5% on eight of the nine measures and 12% of the Low group scored within the botton 5% on the remaining measure. The Middle group on the Bayley Mental Scale was slightly over-represented among the high scorers on the outcome variables (from 5.6% on the 6-year ITPA to 10% on WRAT Arithmetic) and slightly under-represented among the low scorers on these same variables (from 3.5% on the Binet to 4.8% on the WRAT Spelling).

There was no consistent pattern for members of the High Bayley Mental group. On two measures, 5-year ITPA and 7-year WISC, equal proportions (3.8% and 5% respectively) of the High group scored in the top and in the bottom 5%. On two additional measures, WRAT Reading and WRAT Spelling, a greater proportion of the High group scored in the lower than in the upper 5% while on the remaining five measures members of the High group were more frequently found in the upper than in the lower 5%.

Tables 6 & 7 about here

On each of the Bayley Scales subjects scoring within either the upper or the lower 5% were grouped according to SES level. Those with SEI scores within the upper and lower quartiles of the study population were classified as

High and Low SES respectively while subjects scoring between the 25th and 75th percentile were classified as Middle SES.

Within the Low Mental group there were significant differences associated with SES level on three of the nine outcome variables: the six-year MRT ($p < .023$), the six-year ITPA ($p < .011$), and the seven-year WRAT reading test ($p < .035$). In all instances the High SES group obtained the most favorable scores while the Low SES Group obtained the least favorable scores.

For subjects who earned High scores on the Mental Scale there were significant differences associated with SES on six of the nine outcome variables: four-year Binet ($p < .034$), six-year MRT ($p < .003$), seven-year WISC ($p < .007$), and all three sections of the seven-year WRAT, reading ($p < .014$), spelling ($p < .009$), and arithmetic ($p < .004$). In each instance the High SES group obtained the most favorable mean score while the Low SES group obtained the least favorable mean score. Results of the Newman-Keuls test revealed that for the following variables, six-year MRT, WISC, and WRAT reading and spelling, the overall significance of the differences among the three SES groups was the result of the very high scores obtained by the High SES group.

For the Low Motor group there was a significant difference associated with SES level on only one outcome variable, the six-year MRT ($p < .042$) while differences on the six-year ITPA approached significance ($p < .059$).

For the High Motor group there were significant differences associated with SES classification on four of the outcome variables, four-year Binet ($p < .006$), five-year MRT ($p < .022$), five-year ITPA ($p < .004$), and six-year MRT ($p < .005$). In each instance the significant differences among the three SES groups were the result of the very high scores obtained by the High SES group.

Discussion

Moderate product-moment correlations ranging in magnitude from .11 to .26, were found between scores on the Bayley Infant Scales and outcome variables measured at ages four through seven with the highest correlations found between Bayley scores and the four, five, and six year measures. The two Bayley Scales predicted performance on the outcome variables with approximately equal accuracy. While the predictive correlations were in each instance significantly different from zero, none were of sufficient magnitude to be of practical value in individual predictions.

When comparisons were made between subjects scoring in the High (upper 5%), Middle (5th to 95th percentile), and Low (lower 5%) groups on the Bayley Scales, it was found that subjects who scored within the Low groups scored significantly (beyond the .001 level of significance) lower than the Middle groups on all of the outcome variables. However, subjects who scored within the High group did not differ significantly from the Middle groups on any outcome variable with the exception of the four-year Stanford-Binet where differences did favor the High Bayley group.

It has been suggested (Knobloch & Pasamanick, 1963; Drillien, 1961) that for infants who are normal at birth, later IQ will be more closely associated with SES level than with infant measures of development.

Results of the present study clearly indicate the Low performance on the Bayley Infant Scales is associated with lowered performance on all of the intellectual and academic outcome measures, whereas high performance on infant measures bears no relationship to performance on eight of the nine outcome measures administered at ages four through seven. These results support previous findings that low infant performance is more

clearly predictive of later development than is average or high infant performance.

Results of the current study further indicate that for subjects who were Low on the initial infant measures, SES was not clearly and consistently related to later performance. However, where significant differences on outcome variables did exist they favored the High over the Low SES subjects. For subjects who were high (upper 5%) on infant development scales, later performance on measures of intelligence and achievement were in the majority of instances associated with SES level to the extent that High SES subjects obtained the most favorable scores while scores of Middle and Low SES subjects regressed toward the mean of the study sample.

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Table 1

Mean Scores and Standard Deviations on Measures of SES, Infant Development, IQ, School Readiness, Language Development, and School Achievement for the Present Study Sample (N = 1382)

Measures	$\bar{X}$	S.D.
Socioeconomic Index	5.3	1.9
8-mo. Bayley Mental Scale	79.3	5.1
8-mo. Bayley Motor Scale	34.1	4.3
4-yr. Stanford-Binet IQ	104.0	15.9
5-yr. MRT[1]	29.8	14.1
5-yr. ITPA[2]	59.3	11.5
6-yr. MRT[1]	55.6	17.5
6-yr. ITPA[2]	73.9	12.6
7-yr. WISC IQ	103.2	14.0
7-yr. WRAT[3]:		
Reading	35.8	12.4
Spelling	24.6	5.4
Arithmetic	20.6	3.5

[1]Metropolitan Readiness Tests raw scores

[2]Illinois Test of Psycholinguistic Ability language age scores

[3]Wide Range Achievement Test raw scores

Table 2

Correlations Between Bayley Scales of Infant Development and Measures of SES, IQ, School Readiness, Language Development and Academic Achievement for Total Study Sample (N=1382)

Measures	Mental Scale	Motor Scale
	r	r
Bayley Mental	—	.55[1]
Bayley Motor	.55	—
SEI	.05	.08
4-yr. Binet	.23	.22
5-yr. MRT	.16	.17
5-yr. ITPA	.23	.20
6-yr. MRT	.21	.22
6-yr. ITPA	.26	.22
7-yr. WISC	.17	.21
7-yr. WRAT:		
Spelling	.11	.14
Reading	.12	.13
Arithmetic	.17	.16

[1]All correlations reported are significantly different from zero at .01 level

Table 3

Analysis of Variance of Mean Scores of Low, Middle, and High Bayley Subgroups on Measures of SES, IQ, School Readiness, Language Development, and Academic Achievement

	Bayley Mental Scale				Bayley Motor Scale			
	Low	Middle	High		Low	Middle	High	
N:	67	1241	74		69	1243	77	
Measures	$\bar{X}$	$\bar{X}$	$\bar{X}$	p	$\bar{X}$	$\bar{X}$	$\bar{X}$	p
SEI	48.6	53.3	51.5	NS	47.4	53.4	52.6	.03
4-yr. Binet	88.8	104.5	108.7	.00*	88.1	104.8	106.9	.00
5-yr. MRT	18.1	30.4	30.0	.00	18.4	30.5	28.0	.00
5-yr. ITPA	49.0	59.7	61.0	.00	48.2	59.9	60.1	.00
6-yr. MRT	39.8	56.2	57.3	.00	39.8	56.3	56.1	.00
6-yr. ITPA	60.8	74.4	75.1	.00	59.7	74.6	74.3	.00
7-yr. WISC	90.5	103.7	104.4	.00	90.6	103.8	103.4	.00
7-yr. WRAT Reading	29.1	36.2	35.7	.00	28.8	36.1	38.2	.00
Spelling	22.1	24.7	24.6	.00	21.4	24.7	25.8	.00
Arithmetic	18.0	20.7	21.0	.00	18.0	20.8	21.1	.00

* Significant beyond the .01 level.

Table 4

Percentage of High, Middle and Low Bayley (Mental Scale) Subjects Scoring in Upper and Lower Five Percent on Measures of Intelligence and Achievement

Measures	Bayley Groups		
	Low %	Middle %	High %
4-year Binet			
Upper 5%	0	6.0	10.0
Lower 5%	22	3.5	4.4
5-year MRT			
Upper 5%	0	6.0	4.0
Lower 5%	23	4.3	0.0
5-year ITPA			
Upper 5%	2	6.4	3.8
Lower 5%	25	4.7	3.8
6-year MRT			
Upper 5%	0	5.7	10.0
Lower 5%	25	4.7	5.0
6-year ITPA			
Upper 5%	0	5.7	10.0
Lower 5%	25	4.7	5.0
7-year WISC			
Upper 5%	0	6.0	5.0
Lower 5%	25	4.0	5.0
7-year WRAT:			
Reading			
Upper 5%	0	6.9	3.3
Lower 5%	24	3.7	8.2
Spelling			
Upper 5%	2	7.0	3.3
Lower 5%	12	4.8	5.0
Arithmetic			
Upper 5%	2	10.0	8.0
Lower 5%	24	4.6	5.0

Table 5

Percentage of High, Middle and Low Bayley (Motor Scale) Subjects Scoring in Upper and Lower Five Percent on Measures of Intelligence and Achievement

Measures	Bayley Groups		
	Low %	Middle %	High %
4-year Binet			
Upper 5%	0.0	6.4	10.0
Lower 5%	23.0	3.3	4.4
5-year MRT			
Upper 5%	1.8	5.8	6.6
Lower 5%	25.9	3.8	2.2
5-year ITPA			
Upper 5%	0.0	6.2	10.6
Lower 5%	27.8	4.2	8.5
6-year MRT			
Upper 5%	0.0	6.0	5.2
Lower 5%	25.0	4.5	7.0
6-year ITPA			
Upper 5%	0.0	5.8	5.3
Lower 5%	22.0	3.6	7.0
7-year WISC			
Upper 5%	0.0	6.3	6.1
Lower 5%	19.0	4.4	4.6
7-year WRAT:			
Reading			
Upper 5%	0.0	6.5	11.0
Lower 5%	17.9	4.3	3.0
Spelling			
Upper 5%	1.8	6.8	11.0
Lower 5%	16.4	4.8	1.6
Arithmetic			
Upper 5%	1.8	10.0	13.7
Lower 5%	16.4	4.8	4.6

Table 6

Mean IQ, School Readiness, Language Development and Achievement Outcomes Associated with High and Low Bayley Mental Scale Performance for Subjects of Different SES Levels

Measures	Low Bayley Mental Scores				High Bayley Mental Scores			
	Low SES (N=19)	Middle SES (N=37)	High SES (N=9)		Low SES (N=21)	Middle SES (N=31)	High SES (N=21)	
	$\bar{X}$	$\bar{X}$	$\bar{X}$	p	$\bar{X}$	$\bar{X}$	$\bar{X}$	p
4-yr. Binet	84.4	89.4	92.1	N.S.	103.3	108.2	116.3	.034
5-yr. MRT	13.1	20.5	22.3	N.S.	31.1	27.3	35.3	N.S.
5-yr. ITPA	45.1	49.6	55.9	N.S.	58.1	62.3	62.2	N.S.
6-yr. MRT	30.3	40.1	61.6	.023	47.4	57.0	67.9	.003
6-yr. ITPA	47.0	63.5	80.0	.011	71.4	75.4	77.9	N.S.
7-yr. WISC	87.2	91.1	95.9	N.S.	99.3	103.6	112.1	.007
7-yr. WRAT: Rdg.	24.9	28.9	38.9	.035	31.4	34.0	43.1	.014
Splg.	21.6	22.0	24.3	N.S.	23.2	23.4	27.6	.009
Arith.	16.2	18.4	20.6	N.S.	19.2	21.7	22.3	.004

Table 7

Mean IQ, School Readiness, Language Development and Achievement Outcomes Associated with High and Low Bayley Motor Scale Performance for Subjects of Different SES Levels

Measures	Low Bayley Motor Scores				High Bayley Motor Scores			
	Low SES (N=21)	Middle SES (N=38)	High SES (N=10)		Low SES (N=19)	Middle SES (N=34)	High SES (N=18)	
	$\bar{X}$	$\bar{X}$	$\bar{X}$	p	$\bar{X}$	$\bar{X}$	$\bar{X}$	p
4-yr. Binet	84.6	90.3	86.8	N.S.	103.0	103.7	119.5	.006
5-yr. MRT	16.3	21.0	15.6	N.S.	22.5	26.8	37.5	.022
5-yr. ITPA	46.3	49.0	49.6	N.S.	56.4	57.5	69.6	.004
6-yr. MRT	33.6	39.7	56.5	.042	50.5	52.7	68.6	.005
6-yr. ITPA	50.7	63.0	70.2	.059	71.6	73.0	79.1	N.S.
7-yr. WISC	90.2	91.4	89.9	N.S.	98.8	103.2	110.0	N.S.
7-yr. WRAT: Rdg.	27.9	28.0	37.5	N.S.	40.8	35.0	43.1	N.S.
Splg.	22.5	20.7	23.7	N.S.	26.7	24.4	28.0	N.S.
Arith.	17.4	18.3	19.0	N.S.	20.6	20.8	22.7	N.S.